
Pallav Aggarwal

Pallav Aggarwal: From Hobbyist to PCB Designer and Embedded Engineer

Interview by Andy Shaughnessy
I-CONNECT007

I recently discovered a great blog by Pallav Aggarwal, a PCB and embedded systems designer based in Bangalore, India. On his blog, he discusses his journey from a young hobbyist to a degreed engineer who designs PCBs and embedded systems for companies all over the world.

On his site, Pallav explains how he endured a two-hour ride each way to college, with part of that trip in a three-wheeled vehicle. Are you that invested in continuing your training and education? In this email interview, Pallav discusses his journey from hobbyist to engineer.

Andy Shaughnessy: Pallav, give us a quick background about yourself, and tell us how you got involved in electronics.

Pallav Aggarwal: I have been an electronics hobbyist for two decades, and now I work as an independent embedded design consultant. I help various companies in India and abroad design embedded products. One of my associations is with a company called M2MLogger in India, where I have helped them develop various IoT products. Before working as a consultant, I worked in various engineering roles in different national and multinational organizations for 15 years.

Around 1998, I was studying for IITs—the most prestigious universities for engineering education in India. I was going through some of the mock tests. While doing so, I came across a one-page electronic circuit in one of the science refresher magazines, and I fell in love with it instantly. I started visiting various electronic component shops nearby to see what these components were, what they looked like, how to buy them, etc. That was when I started exploring electronics in a full-fledged manner.

I began visiting a nearby library to access electronics magazines to go through the published circuits. I built an RF transmitter with a home-etched PCB, and I was able to receive audio on an FM radio receiver one meter away. I was doing these types of experiments every day and night. I was very lucky to have found what I really love to do early in life. When you work in a field you love, you are happy every day and never tired or frustrated. That's a huge thing to achieve.

Shaughnessy: How did you think to take batteries apart and harvest the zinc for resale? What a great idea.

Aggarwal: I used to explore all of the scrap in my home. Seeing me dismantling batteries and cells, my grandfather told me that batteries contained zinc, or jasta in Hindi—an expensive metal used for making corrosion-resistant pipes.

I used to open AA and D batteries and extract the zinc foils. One day, I melted those foils and wound up with a big zinc log, which I then sold in the market. Even then, I think my inner salesman was active! With the zinc money, I bought more electronics—mainly chemicals for my experiments.

Shaughnessy: On your blog, you mentioned that you once rode a bus two hours each way to the Tico Institute of Embedded Technology. You must have been really serious about your training and education. Do you attend conferences, trade shows, or webinars?

Aggarwal: I did, but those were pre-COVID-19 conferences, of course. My parents didn't have much money, and that was the most affordable way to reach the Tico Institute, which was 60 kilometers away from my residence. I used to take an auto—a three-wheeled vehicle—from my house to the train station, a train to Delhi, and then a bus to the training center. A one-way journey would take two hours or more, but I never minded hard work. I think it is in my blood from my father, as well as my grandfather, who was a farmer.

I was crazy about electronics, so I wanted to do whatever it takes to learn. I feel so happy now that I listened to my inner voice and stuck with my passion. I attended many seminars conducted by various semiconductor manufacturing companies in India, such as Texas Instruments and Freescale (now NXP), as well as other exhibitions.

In addition to the seminars and exhibitions, I also visited all of the electronics shops and markets in the city. I have explored them hundreds of times. In Delhi, we have one of India's largest electronic component markets—the Lajpat Rai Market. I understood that I needed to go out and meet people, understand what products the world is making, and improve my own knowledge. I think every engineer should visit these exhibitions and seminars; they help you improve your perspective for whatever you build, and you learn so much from others.

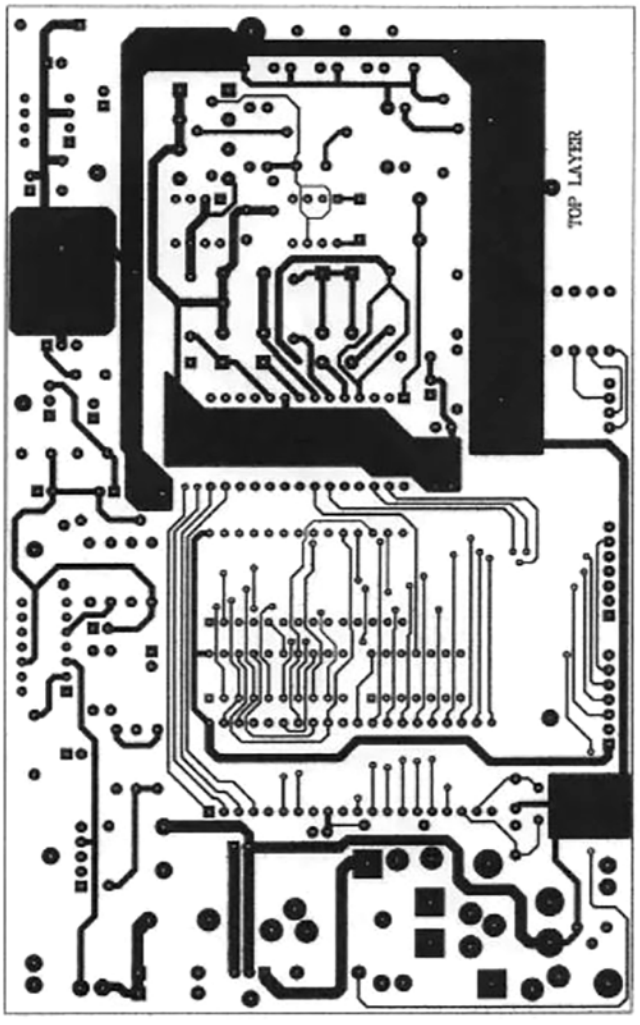

Figure 1: One of Pallav's early designs—a power board laid out with Protel 2.7.

I had poor communication skills back then. I remember being scared to answer the phone at home. English was my second language at school, so talking to people was also a way of forcing myself to speak to people and improve my communication skills. Now, I am like a child when I see new hardware. If I enter your office and see a PCB, I will ask if I can take a look at it.

Shaughnessy: I understand that you learned PCB design by working, almost for free, using Protel. Tell us how you got started in design work.

Aggarwal: When I was first learning about electronics, the PCB was always a part of the circuit. I became curious and started to learn about PCBs, including how they're manufactured and which software tools were used to design them. I somehow arranged to get a copy of Protel 2.7 and started learning design techniques by using the help file. The shortcuts in the help file gave me a quick idea of how to use it. I found it very interesting, and I started making some PCBs to see what I could do.

I visited the Lajpat Rai Market and saw one shop that sold PCBs, such as inverters, chargers, and LED boards, etc. I asked the shopkeeper if I could buy one small PCB. He asked why I wanted a PCB, and I told him that I was learning PCB design and planned to try to design this PCB. The shopkeeper gave me a PCB for free and said, "If you design it correctly and give me the design, I will pay you for it." I was very happy. I came home, designed the PCB, and I think I was paid 40 Indian rupees (about $0.50) for my first PCB design job.

This episode gave me an idea about how to capitalize on my skill. I worked hard and improved my PCB design skills, and then I decided to contact various companies in my city and ask if they had any design work. I explored the phone directory to find all the PCB manufacturers, and I called them all. I told them I was a PCB designer, and soon I was working for 17 different companies. I was getting 10–15 Indian rupees per square inch for my design work. It was very little, but I was on a mission to learn—not to earn. The money was just a bonus.

Shaughnessy: You're involved with embedded system design, AI, and all kinds of Arduino projects. What is your favorite part of your job or your sweet spot?

Aggarwal: I help companies build embedded products, which includes hardware and firmware/software. For many, I help improve the company's existing designs for size, power consumption, cost, reliability, etc. I do both hardware design and firmware as part of the complete embedded design. I regularly review technical specs, hardware designs/schematics, and overall design architecture.

I have gained many years of embedded firmware (MCUs/MPUs) design experience as well, so I love architecting new products, finding issues in a client's specs and designs, and helping them improve based on my field experience. The best part of my job is determining the client's new project requirements and challenges and helping them with different architectures and strategies in the design. That's the most challenging part as well.

Shaughnessy: Do you primarily design for companies that export products or for the domestic market in India?

Aggarwal: I have clients in India, Africa, Saudi Arabia, and in other parts of the world as well. My clientele is a mix: Some manufacture for domestic needs and others are exporters. I am now exploring opportunities in the U.S. and Europe. I want to associate with a few good companies and help them build successful products.

Shaughnessy: How has the COVID-19 outbreak changed the way you do your job and the electronics industry in India?

Aggarwal: COVID-19 is terrible. Everyone is at home. Just before India started the lockdown, I had traveled to Dubai for an exhibition and a few meetings. I can see that business is moving very slowly. New projects are on hold until the situation improves. Many companies have taken this as an opportunity to face their shortcomings and improve what they've always wanted to improve but never had the time.

Likewise, while I have a smaller load of commercial projects, I am building some software IP that could be reused in projects in the future. I have started developing some open-source embedded projects that can help the embedded community at large. One is a low-

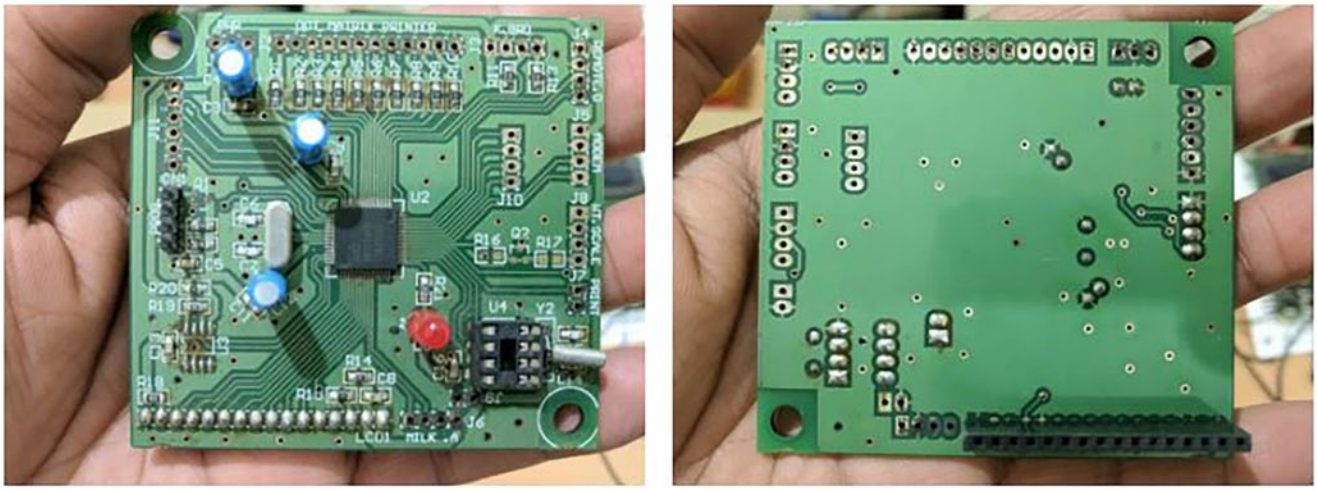

Figure 2: Pallav works on embedded systems designs as a hobby.

power measurement device that could be used for measuring microampere or even lower currents. There are no good solutions available in the market if you want to measure the power consumption of your low-power embedded/IoT device.

India is a market where personal relationships are more powerful, and face-to-face meetings are preferred, but COVID-19 has changed this fundamentally. People are more digital now, so digital meetings and online demos are more acceptable now in India. Post-COVID, businesses will be more acceptable to remote work than before.

Shaughnessy: What advice would you give to someone just starting out designing PCBs or embedded systems?

Aggarwal: My first advice is to do what you love. If you love football, don't bother about hardware, but if you love electronics, go all out and think long term. Young engineers are looking for quick results, quick money, and quick fame. There are no shortcuts. Be ready for many days, weeks, and months of debugging and reworking.

Believe me, the happiness of working on what you love is 100 times more satisfying than any money or any fame. It's also easier to perform well if you're doing what you love. Work hard every single day and have patience. It takes time to build knowledge and experience, and sometimes we lose patience and start thinking that we are less intelligent or this career is not for us. Don't get into that mode. You have to tell yourself that you can do it.

Don't worry about failures, either. Review what you have achieved in a year, not in an hour. Improve your knowledge every day. When I first started, I didn't have a computer or internet at home, and Google and YouTube were not yet born. Today, your educational possibilities are huge.

Remember that PCBs are central to electronics. Start with the basics. Learn how PCBs are manufactured and become familiar with different terminologies. Always ask, "Why is it this way, and not that way?" This curiosity will help you gain in-depth knowledge of the subject.

For engineers exploring embedded systems, I have the same advice. Please understand that embedded systems encompass hardware and firmware—not just firmware, as many might think. Hardware knowledge helps in a big way if you want to be a truly embedded design engineer.

Shaughnessy: Is there anything else you'd like to add?

Aggarwal: Around 2016–2017, while heading an engineering team in India for a Swiss-based system-on-module manufacturing company, I had the opportunity to travel and meet hundreds of customers. I discovered that many

engineers lack knowledge and proper direction, so I started to write articles that I thought might help some of these engineers.

Over a period of time, I realized that I should have my own website to have everything organized well and available in one place. My long-term goal is to build a very good and practically applicable knowledge base for embedded systems engineers and maybe write a book someday. I hope to help them in their journey and give back to society in my own way.

Today, I am what I am because so many people gave me direction and guidance. Now, it's my turn. Thank you for the opportunity to share my journey with you. I wish all readers a healthy and happy life.

Shaughnessy: Thank you, Pallav. I appreciate it. This is a really good story.

Aggarwal: Thank you. DESIGN007

Ergotron's New Thermal Imaging Cart Supports a Healthier, Safer Return to Work

Ergotron, a global movement company that builds environments that help people thrive, announced the launch of its Thermal Imaging Cart with Onboard Power designed to quickly detect a temperature in spaces where groups of people gather.

As employers slowly start to bring their teams back to work, businesses gradually begin to reopen, and educators weigh their options for the upcoming school year, safeguarding public health is a top priority. Thermal imaging technology brings body temperature measurement wherever it's needed to support efforts to maintain healthy communities.

Ergotron's Thermal Imaging Cart provides total flexibility. The cart's open architecture allows for customers to mount their thermal imaging camera of choice facing forward or backward depending on the application or to accommodate privacy considerations. The easy-to-clean mobile cart is compact and fits in small spaces so it can travel to wherever it's needed. Optional accessories like a sani-wipes holder make disinfection simple and the onboard LiFe battery technology provides a safe and reliable charge.

"We developed the Thermal Imaging Cart based on a need we recognized in our customers and in the marketplace," said Megan Nightingale, general manager, industrial, education and new markets at Ergotron. "As we navigate this new world we're in, we've seen a huge demand for thermal imaging solutions. Our cart fits a variety of thermal imaging cameras and we're excited to introduce this solution to support employers, businesses and educators as they work to keep their populations healthy."

In addition to the Thermal Imaging Cart with Onboard Power, a Thermal Imaging Cart with Hot Swap Power is also available to order. Hot swap power, with Ergotron's innovative LifeKinnex Technology, allows for uninterrupted workflows. These carts can be ordered from resellers globally.

(Source: Business Wire)